

5 year
MARSH AND WATER MANAGEMENT PLAN

Clarence Cannon National Wildlife Refuge

1984

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MARSH AND WATER MANAGEMENT PLAN

I. Introduction

The marsh and water management plan outlines and describes management strategies for maintenance, rehabilitation, and development of managed waters on the Clarence Cannon National Wildlife Refuge, and Delair and Gardner Divisions of the Mark Twain National Wildlife Refuge. This plan covers a five year period beginning in October, 1984.

Management of waters on the three units is geared toward meeting primary objectives cited in the Master Plan for the Mark Twain National Wildlife Refuge (1979). These objectives include:

- 1) Provide food, cover, and protection for migrating waterfowl during spring and fall months.
- 2) Improve and maintain existing habitat to perpetuate optimum annual production of wood ducks.

Water management strategies have been designed to also provide optimum habitat and protection for endangered species, primarily bald eagles, and other migratory birds, and to meet Regional Resource Planning Strategies where applicable to the three units.

Management projects are geared heavily toward maintenance and rehabilitation over the five year period. Projects are designed to be completed force account with existing manpower and equipment.

Funding received from other than Operation and Maintenance activities, such as ARMM funding, can be targeted for high priority projects that fall within funding guidelines. Increased funding will make it possible to complete all aspects of the plan in less than five years.

The marsh and water management plan is subdivided into three refuge and refuge division plans for better organization. A synopsis of refuge staff and equipment to be utilized on all three units preceeds the unit plans.

STAFFING

Currently refuge staff number five personnel and include the following:

1. Refuge Manager - GS-11
2. Assistant Refuge Manager - GS-7
3. Secretary - GS-4
4. Maintenance Mechanic - WG-9
5. Tractor Operator - WG-5
- limited to operation of vehicles weighing up to and including 7,000 lbs.

Refuge staff, headquartered at Clarence Cannon NWR, also manage the Delair and Gardner Divisions of the Mark Twain NWR, and are included in the Mark Twain NWR Complex for administrative purposes.

Staff number, types, and grade levels are not expected to change within the next five years.

EQUIPMENT

Much of the equipment required to execute the marsh and water management plan is old, and requires more than normal repair on an annual basis. Replacement requests of some equipment items have been initiated. Current funding looks minimal, and it is doubtful that any of these items will be replaced in the next five years.

Major equipment to be utilized include the following:

1. Dozer, D-8, Caterpillar. This 30 year-old tractor is scheduled for use in more than 95% of all water management projects. Annual maintenance and part replacement in 1984 exceeded \$5,000 in labor and materials and is expected to increase annually over the next five years.
2. Dragline Crane, 1 yard, American. This crane was transferred from Squaw Creek NWR in May 1984. It is in excellent condition and will be involved in rehabilitation and maintenance of major ditches on Clarence Cannon NWR.

3. Dragline Crane, 3/4 yard bucket, Schield-Bantam on wheeled M-44 truck (surplus). The age of this vehicle is estimated at close to 40 years old. Maintenance of the unit has become an almost impossible task due to the lack of replacement parts. A wheeled dragline crane or backhoe is critical in the execution of this plan on Delair Division as well as Clarence Cannon NWR.
4. Stake Truck, 2½-ton, Ford. This vehicle is to be utilized in transport of equipment and structures. The vehicle has over 150,000 miles on it and annual maintenance is excessive.
5. Dump Truck, 5-ton, IH. This vehicle will be used to haul materials to and from rehab and development project sites. Its odometer also exceeds 150,000.
6. Road Grader, D-12, Caterpillar. This vehicle is in very poor condition, and it requires intensive maintenance each time it is used. It will be utilized in construction and maintenance of low level dikes and levees.
7. Boom Mower, attached to Ford tractor, Terrain King. Purchased in 1984, this new item will be utilized cyclical maintenance of dikes, ditches and levees, along with a 9' sickle bar and rotary mower pulled by John Deere 2640 tractors, which are in good condition.
8. Pump, 8 inch, Crisafulli, 2. These pumps are in excellent condition and will be utilized in flooding certain areas and in water removal for control structure maintenance.

CONTRACTED SERVICES

During the planning period, funds may become available to complete projects via contracted services. The ARMMS program provides the greatest potential for funding availability during this period.

Funding for contracted services would greatly accelerate the completion of extensive rehabilitation planned for Clarence Cannon NWR and Delair Division, and in many cases, prove to be more economical for the Service.

For example, needed rehabilitation of water management ditches requires extensive site preparation to allow access by heavy equipment. Site preparation accounts for up to 50 percent of the total cost for ditch rehabilitation. This cost could be saved through the use of contracted services to clear ditches with ditching explosives. Little site preparation would be required and there would be a substantial savings in time and manpower.

Due to the number of means available through contracted services and the uncertainty of funding during the planning period, options such as ditch blasting have not been incorporated in this plan. Should funding become available, we shall seek the best available means to complete projects. Otherwise, project completion is planned under current O & M funding levels.

MARSH AND WATER MANAGEMENT PLAN

for the

Clarence Cannon National Wildlife Refuge

AREA DESCRIPTION

Clarence Cannon NWR is located near Annada, Missouri and contains approximately 3,736 acres, situated entirely within the Mississippi River floodplain. The refuge is bounded by an eight foot earthen levee that protects the area from inundation by the Mississippi River up to 454 feet m.s.l., which is approximately seven feet above flood stage at Lock and Dam #24 (COE), located ten miles north.

Variance in elevation throughout the refuge is less than six feet, except for levees, dikes, and ditches, and ranges from 437 feet to 443 feet m.s.l. Soils are primarily Wabash silty clay, generally clayey with poor internal drainage. These factors, plus an immediate water source, make the refuge an ideal location for moist soil development.

A synopsis of existing land types on Clarence Cannon NWR is presented in Table C.1.

Table C.1. Land Resources Inventory for the Clarence Cannon National Wildlife Refuge, October 1984.

LAND TYPE	DESIGNATION	ACREAGE	WATER VOLUME W/ AVG. DEPTH 1 FT.	REMARKS
MOIST SOIL UNIT Total Acreage-859	Supply Pond	37	37 ac./ft.	
	#1	47	47 ac./ft.	
	#2	154	154 ac./ft.	
	#3	93	93 ac./ft.	
	#4	82	82 ac./ft.	
	#5	126	82 ac./ft.	
	#6	37	37 ac./ft.	
	#11	23	23 ac./ft.	Requires dbl
	#12	23	23 ac./ft.	pump.
	#13	27	27 ac./ft.	"
	Goose Pasture	120	100 ac./ft.	"
	Big Pond	90	90 ac./ft.	
SEASONALLY-FLOODED BASINS Total Acreage-54	Crane Pond	21	21 ac./ft.	
	Rabbit Ears Marsh	20	20 ac./ft.	
	Upper Rabbit Ears	13	13 ac./ft.	
SHALLOW FRESH MARSHES Total Acreage-72	Raybourne Slough	12	12 ac./ft.	
	Ballbush Pond	5	5 ac./ft.	
	Display Pond	10	10 ac./ft.	
	Various Unnamed Marshes and Borrow Ditches	45	45 ac./ft.	None more than 3 ac. in size.
RIVERS & STREAMS Total Acreage-14	Bryant's Creek	13	N/A	
	Ramsey Creek	1	N/A	
GREEN TREE RESERVOIRS	Goose Pasture	88	66 ac./ft.	
	Pecan Grove	85	72 ac./ft.	
	Stephen's Landing	64	54 ac./ft.	
WARM-SEASON GRASS STANDS	Unnamed	60		3 Stands.

Table C.1. Land Resources Inventory for the Clarence Cannon
National Wildlife Refuge, October 1984. (continued)

LAND TYPE	DESIGNATION	ACREAGE	WATER VOLUME W/ AVG. DEPTH 1 FT.	REMARKS
ACTIVE CROPLAND	1A, 6B, 8A, 8B, 9A, 9B, 10, 13A, 13B, 13C, 14A, 14B, 15, 16, 18A, 18B, 18C, 19, 20, 24, 25, 26A, 26B	1,067		Soybeans-700 acres Corn-146 acres Wheat-164 acres Milo-46 acres
IDLED CROPLAND	N/A	573		
ADMINISTRATIVE Bldgs., Parking Lots, Roads	N/A	60		
WATER MGMT. FACILI- TIES Dikes, Levees, Ditches	N/A	291		
BRUSHLAND	N/A	200		
FORESTLANDS	N/A	249		

TOTAL ACREAGE-----3,736

The refuge currently has eleven manageable moist soil units totalling approximately 859 surface acres, three green tree reservoirs totalling approximately 237 acres, and six semi-permanent or permanent water bodies totalling approximately 140 acres. All idle lands and 50% of the existing cropland, together totalling approximately 1,100 acres, have the capacity for becoming moist soil areas.

WATER MANAGEMENT HISTORY

The refuge was purchased in 1964 with funds from Federal Duck Stamp sales. The area remained in a natural state until the early 1920's. Early residents in the area described it as a low, wet area covered extensively by cordgrass. Waterfowl use was minimal at that time, but the area did provide excellent hunting for swamp rabbits. Permanent and semi-permanent water bodies were much the same as they are today.

In the early 1920's, rice farmers broke ground on the area, built the levees that border the refuge, and constructed a drainage system to facilitate production. However, costs of production and prices received for the crops made production uneconomical and rice farming was halted.

After rice farming proved unsuccessful, the area was farmed for various row crops until establishment of the refuge. During this period, the area was visited by large numbers of migrating waterfowl, being drawn presumably by the crops. Waterfowl hunting was so outstanding during the late '40s and '50s that hunters would ride the train from St. Louis and get off at Annada for a day's hunting.

Water management consisted of dewatering the area every spring in order to plant crops, and keeping the water off until after crops were harvested. The area was part of the Elsberry Drainage District, and water was removed through a sluice box located on the southern edge of the present refuge.

After the area was purchased and given national wildlife refuge status, water management was intensified to provide standing water over

more extended periods of time. A new pumping station was built at the sluice box location, but now water was pumped in and out of Bryants Creek utilizing two 20,000 g.p.m. pumps. The first diked moist soil units were constructed in 1969 -- three, square, 20 acre ponds located in the northwest portion of the refuge and called Millet Ponds A, B, and C.

By 1978, six new moist soil units had been constructed and water control structures had been placed on Goose Pasture, Big Pond, and Upper Rabbit Ears Marsh.

Since then, no new development of moist soil areas has taken place on the refuge. Maintenance and rehabilitation have been limited to small 'catch-as-you-can' projects, except for rehabilitation of portions of the north, south, and west levees. Because of this, several sections of the main drainage ditch are heavily silted and vegetated with woody species. Water cannot be manipulated to provide optimum conditions.

Rehabilitation of the river (east) levee was discussed by a multidisciplinary action team in the spring of 1984. The levee has been breeched in at least one spot during almost every major flood occurring in the last twenty years and requires extensive rehabilitation.

Up until 1984, planted cropland exceeded 1,000 acres on the refuge. Clarence Cannon NWR's new direction in land management will change many of these acres to natural production of moist soil plants.

REFUGE OBJECTIVES

Waterfowl maintenance objectives for Clarence Cannon NWR include 3,000,000 duck use days and 400,000 goose use days annually. Duck use days have shown a decline over the past five year period, averaging only 1,189,494 duck use days annually. Goose use days are close to our goal, averaging 375,000 annually over the past five year period. Selected objectives for Clarence Cannon NWR are presented in Table C.2.

Table C.2. Management Objectives Deficit/Excess for the Clarence Cannon National Wildlife Refuge, October 1984.

Output	Current Level	5-Year Average ¹	Mid-Range Objective Level ²	Deficit (-) Excess (+)
<u>Waterfowl Maintenance:</u>				
Ducks	1,126,440	1,189,494	3,000,000	-1,810,506
Geese	289,620	375,538	400,000	-24,462
<u>Waterfowl Production:</u>				
Wood Duck	200	171	150	+21
Mallard	8	34	300	-266
<u>Endangered Species:</u>				
Bald Eagle	725	359	430	-71
<u>Other Migratory Species:</u>	92,736	158,768	44,600	+114,168
Coot	18,643	77,310	-	-
Marsh & Water Birds	11,970	13,241	-	-
Shorebirds, Gulls, Terns	9,487	61,714	-	-
Raptorial Birds	2,036	3,378	-	-
Mourning Dove	600	3,125	-	-

¹ For the period FY 1979-1983

² From Master Plan for the Mark Twain NWR (1979)

Bald Eagle and other migratory species use days have shown a steady increase over the past five years. Waterfowl production needs to be increased, particularly by mallards.

The major objectives of the Marsh and Water Management Plan for the Clarence Cannon NWR are to increase and maintain substantially higher duck use days and waterfowl production while meeting the goals for other migratory species, bald eagles, geese, and resident wildlife population balances.

ACTION PLAN

Management projects and strategies outlined in this plan will allow Clarence Cannon NWR to meet and maintain its objectives. The key factor to a successful program on Clarence Cannon NWR is water manipulation. The ability to manipulate and maintain water at varying levels throughout the year is imperative to attaining optimum moist soil conditions. To reach this goal, extensive rehabilitation and maintenance of water management facilities are planned. New development of moist soil areas will proceed at a steady pace so that, by the end of the five year planning period, moist soil areas on Clarence Cannon NWR will be increased 44%, from 859 acres to 1,515 acres.

Rehabilitation, maintenance, and development projects are scheduled by priority in this plan. A general time schedule for completion of projects is included in Appendix B, but it is subject to change caused by variabilities in funding, manpower and equipment, and weather conditions. A priority schedule will allow for flexibility in project completion. For example, if a higher priority project cannot be initiated due to equipment breakdown, the next lower priority will be initiated. The first project will be continued as soon as it is possible.

The action plan is subdivided into four categories: Management Strategies, Rehabilitation, Development, and Cyclical Maintenance. A priority listing of projects is presented in Appendix B.

Monitoring and Evaluation of Management Practices

In order to gauge the effectiveness of the marsh and water management program, a more intensive system of monitoring and evaluation must be put into effect.

Monitoring and evaluation procedures will be conducted by the refuge manager and assistant refuge manager and reported to the Regional Office on an annual basis via the 'Annual Water Management Plan.' The plan will include a synopsis of water management, completed projects, vegetative response, and wildlife use for the previous fiscal

year and describe planned water management and projects for the coming fiscal year. Format for the annual water management plan is described in Appendix D.

Throughout the year, wildlife use will be recorded at least once per week during summer and winter, and at least three times per week during peak migration periods. Observations of wildlife activity will be noted, such as whether ducks are loafing or actively feeding in moist soil areas. More information on census techniques can be found in the refuge Wildlife Inventory Plan..

Vegetative transects shall be conducted during the period from late August to mid-September in all moist soil areas. Vegetation species, height and seed production will be recorded by the observer walking linear transects and using a square meter quadrat every 20 paces (approximately 60 feet).

Gauge readings shall be recorded for all moist soil areas daily if possible and charted on a graph at year's end, along with other data pertinent to the moist soil unit. An example of this graph, along with examples of wildlife use and vegetative transect forms is presented in Appendix D.

Rehabilitation

Though cyclical maintenance will require the most staff hours annually, rehabilitation projects will remain the highest priority. Rehabilitation of water management facilities is the primary means to meeting our objectives within a five year period.

Major rehabilitation is planned for the east and south levees, the main ditch system, and numerous field ditches to increase our ability to manipulate water on the refuge. Development of new moist soil units depends upon the rehabilitation of water management facilities. The following text explains each planned rehabilitation project by priority. Cost analysis and general scheduling of projects are presented in Appendices A and B.

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1. East Levee

The east levee of Clarence Cannon NWR is located adjacent to the Mississippi River. Because of its location, the east levee is considered the first line of defense against flooding of the refuge and the Annada Flood Protection District. Built in the 1920's (see Area History), the east levee has received only minimal maintenance since then. Maintenance of the levee since its purchase by the Service has included prescribed burning, mowing, and herbicide application to maintain a grass covering and set back woody species and forbs. However, due to steep levee slopes that don't allow equipment to reach levee bottoms, several trees up to 16 inches DBH have grown on the sides of the levee. The levee is laced with a network of sand veins that can be opened up by large tree roots, causing natural seeps to increase, and threatening the physical integrity of the levee.

Also wave action damage caused to the levee during high water conditions have eroded portions of the levee. These eroded areas cannot withstand high water pressure over extended periods of time and threaten to 'blow out' during flood periods, as has been the case four times since 1965, when the refuge was purchased.

Rehabilitation of the east levee would require extensive tree removal, and repair and resloping of wave damaged areas. Rehabilitation of the east levee is imperative to the continued management of moist soil areas on Clarence Cannon NWR. This was the concensus of participants at the Clarence Cannon NWR workshop held in March 1984 by the USFWS Western Energy and Land Use Team.

Funding in the amount of approximately \$90,000 is tentatively scheduled for levee rehabilitation in FY 86. Though it remains as the top priority project under the marsh and water management plan, major rehabilitation of the east levee will be postponed until FY 86, when funding for contract work may or may not become available.

2. South Levee

This levee runs adjacent to Bryants Creek on the refuge's southern boundary. Several low, soft areas on the levee top constitute a major flooding threat during high water conditions. Two sections on the levee, totalling .3 miles, provide flood protection only to approximately 447.5 m.s.l., two feet below the protection level of the rest of the levees.

Rehabilitation of the south levee will include build-up of the levee top to 449.5 m.s.l., utilizing the IH 806 tractor with 1 yard scraper. Reconstructed areas will be seeded with a mixture of K31 fescue and reed canary grass, with Caldwell wheat used as a soil stabilizer and nurse crop.

3. Main Ditch System

The main ditch system on Clarence Cannon NWR is a continuous, 7.37 mile open ditch that runs full circle within the refuge. It is the primary vehicle for drainage and flooding of the entire refuge, and particularly the moist soil units. Several sections of the main ditch system have received little maintenance in the past several years. These sections are characterized by heavy siltation and woody species invasion both within the ditch and on the ditch spoil. Rehabilitation of these sections will allow a substantial increase in water flow through the system, which is now partially blocked. This project is also geared toward providing access to the ditch system for cyclical maintenance.

Sections of the main ditch have been delineated with alphabetical letters as presented on Map C, Appendix A. That section of the main ditch running between a point approximately 900 feet east of Hemphill Crossing to a point where the main ditch makes a 90° turn to the east of Big Pond (approximately 1.3 miles) is not scheduled for rehabilitation. Labeled Section H, this portion of the main ditch runs through heavy timber on the east side of the refuge and rehabilitation would be cost prohibitive. The area covered by Section H will drain and fill adequately if the remaining ditch is maintained.

Rehabilitation of 9 out of 12 main ditch sections is planned. They are, in order of priority:

- | | | |
|--------------|--------------|--------------|
| 1. Section E | 4. Section F | 7. Section J |
| 2. Section D | 5. Section G | 8. Section I |
| 3. Section L | 6. Section C | 9. Section K |

Sections A and B are in relatively good shape and require only cyclical maintenance.

Funding for rehabilitation of the ditch system, in the amount of \$70,000, is tentively scheduled for FY 86. However, ditch rehabilitation will be initiated as soon as possible, with rehabilitation of sections E and D tentively scheduled for CY 85.

These projects will require utilization of the D-8 dozer and the American dragline crane. Trees and brush will be cleared from one side of the ditch to facilitate access for the dragline crane. Then, silt and vegetation will be excavated from the ditch. Depth of excavation will be determined by on-site survey prior to and during the operation.

4. Field Ditches

Field ditches include all ditches other than the main system on Clarence Cannon NWR. Presently, these include interior feeder ditches in moist soil areas, major 'W'-ditches, and ag field ditches. All ditches require at least some degree of rehabilitation, primarily silt and vegetation removal in order to function properly. Required equipment includes road grader, D-8 dozer, and IH 806 tractor with 14-16" rotary ditcher attachment. Much of this work can be completed by the WG-5 tractor operator.

DEVELOPMENT

Development of six new moist soil units is planned to be accomplished over the five year period in a way that allows rehabilitation and cyclical maintenance to continue as a primary goal. Only moist soil development projects that require the lowest requirements of manpower,

equipment, and supplies will be initiated during the first three years of the planning period, affording more time to rehabilitate and maintain water management facilities. Cost analysis and general scheduling of projects are included in Appendix C.

1. MSU 7

Work has already begun on this new moist soil area, located in the northwest area of the refuge. When completed, MSU 7 will have the capability of impounding approximately 465 surface acres, increasing total moist soil unit acreage by 68%.

The new MSU requires placement of three water control structures (WCS), one of which has already been placed. The two WCSs linking the MSU to the main ditch are flashboard users, which increases the area's ability to trap and hold a preferred water level. The third structure, a 48-inch screwgate, shall be placed in the main ditch immediately north of the primary WCS, and, when closed, will allow backwatering capabilities into MSU 7.

A low level terrace dike, approximately three feet high, six feet wide, with 3:1 slopes will then be constructed from the primary WCS to tie in with a natural ridge on the northeastern boundary of MSU 7, a distance of approximately 1,700 feet. An existing 'W' ditch will be extended 1,000 feet to provide access to the secondary WCS. A small ditch plug placed in the north central section of MSU 7 will complete development.

This new moist soil unit will provide a diversity of water levels and is estimated to increase waterfowl use days by approximately 802,125 annually. Impoundment is provided by natural contours, so development and cyclical maintenance costs for dike construction are minimal.

2. MSU 3 Addition

Perhaps the simplest of all development projects, this development will provide an additional 70 acres in moist soil areas. The west dike of MSU 3 will be widened and resloped to facilitate access to ag units 20 and 24. Two 18" corrugated metal pipes will be placed in the north and south ends of the west dike, and an existing ditch adjacent to the dike will be cleaned to facilitate drainage. The southern end of the west dike will be extended to an existing spoil on the south end of ag field 18C.

Flooding of MSU 3 will provide sheet water in the new addition, which is estimated to increase waterfowl use days by 120,750 annually.

3. Rabbit Ears Marsh

This 20 acre area is currently classified as a seasonally-flooded basin and is directly connected to the main ditch in two locations. Due to siltation in the main ditch, water usually remains in Rabbit Ears Marsh into August before it dries via evaporation. Without water manipulation abilities, vegetation within the marsh cannot be controlled. Due to lack of soil disturbance for several years, the marsh has been invaded by non-preferred vegetation including willow, cottonwood, mallow, and buttonbush.

Development of Rabbit Ears Marsh into a moist soil unit can begin only after rehabilitation of main ditch section G. This rehabilitation project will clear the main ditch spoil and terrace it to allow access by heavy equipment, and replace Hemphill Crossing CMP with 4' X 6' concrete box culvert to assure increased water flow in that area.

Development of Rabbit Ears Marsh into a moist soil unit consists of placing a water control structure in the northwest corner of the marsh where a ditch opening already exists. Interior ditching will be accomplished with the D-8 dozer and will allow increased draining efficiency for the new unit. With water control and vegetation manipulation, Rabbit Ears Marsh MSU is estimated to provide an additional 34,500 duck use days annually.

4. Upper Rabbit Ears Marsh

This 13 acre marsh already contains a water control structure (flash-board riser), but requires a small amount of earth levelling to become an effective moist soil unit. Currently, a natural rise of land between the marsh and the WCS does not allow total drainage control, and water remains into July-August, drying by evaporation. Lack of soil disturbance due to this has caused the marsh to be choked with three-square bulrush and the marsh provides few duck use days.

Development of Upper Rabbit Ears Marsh into a moist soil unit will begin with reshaping of the north dike, which holds the WCS. This will be done to alleviate breaching of the dike near the WCS, which has been a problem for several years. Next, the land within the marsh will be levelled to provide optimum drainage. Finally, the ditch that connects Upper Rabbit Ears Marsh with Rabbit Ears Marsh will be cleaned out. With water control and vegetation manipulation, Upper Rabbit Ears Marsh MSU is estimated to provide an additional 22,425 duck use days annually.

5. Big Pond MSU Addition

Development of this area will provide an additional 80 acres of moist soils to the 90 acre Big Pond. Dike work will provide inundation capabilities for ag fields 13B and 19. Low level terrace dikes will be constructed along Big Pond road from the Big Pond flashboard riser to an existing dike on the north edge of the new addition. A flapgate structure located at the west end of main ditch section K will be replaced on the east end, and a screwgate structure will be placed on the west end. These structures will allow for drainage of ag fields to the east of the new addition while maintaining water levels in the MSU.

It is estimated that the 80 acre addition to Big Pond MSU will provide an additional 138,000 duck use days annually.

6. MSU 8

Located in ag field 9A, this area has good potential for high duck

use. It has been a perennial high use area for ducks and geese when planted to crops. The area commonly contains sheet water over 80% of its surface following heavy precipitation (< 3 inches).

A topographical survey of the new moist soil units will be required prior to development to determine total acreage, land contours, and development requirements. It is estimated that development will provide inundation capacity to 65 surface acres. Natural contours will serve to hold water along the north and east borders of the new MSU. Existing roads on the south and west borders will require raising an average of two feet.

An 18-inch screwgate will be placed on the north end of main ditch section L, which will serve as the feeder ditch to the new MSU. Water levels will be maintained at less than eight inches when flooded.

Development of MSU 8 is estimated to increase duck use days by 112,125 annually.

CYCLICAL MAINTENANCE

Cyclical maintenance will require the greatest amount of staff time among all projects covered in the Marsh and Water Management Plan. And as rehabilitation and development projects are accomplished, maintenance requirements will increase.

Much of the maintenance activities will be completed via force account, utilizing existing manpower and equipment. Maintenance activities are divided into three categories:

1. Water Management Facility Maintenance
2. Soil Disturbance
3. Vegetation Control

Additional maintenance requirements may be caused by unforeseen conditions or events, i.e. record flooding, excessive precipitation, mechanical breakdown, and the planning schedule may have to be amended in consideration of such events. Cost analysis and general scheduling

of projects are presented in Appendix C.

1. Water Management Facility Maintenance

This broad category includes maintenance of facilities including: pumps, water control gates, CMP culverts, ditches. Dikes and levees are covered under Category 3 - Vegetation Control.

Water pumps include the two, 20,000 g.p.m. diesel-fueled pumps and the structure they are placed in. The pumphouse facility was revamped this year with placement of new trash guard screens, attachment of a new 2,500 gallon fuel tank, and new paint. Pumps and their engines shall be maintained annually according to normal procedures, i.e., new filters, oil changes, lubrication. No additional maintenance of the pumps or the pumphouse structure is foreseen during the planning period.

No water control gates, flashboard risers, or CMP culverts are planned for replacement during the planning period, except on certain rehabilitation projects. Existing water control gates and flashboard risers are scheduled for repainting during the first two years of the planning period. This will be accomplished by YCC personnel. Beginning in 1985, all structures shall be sumped on both ends to alleviate silt blockage of the structures. This project entails dredging of silt and debris to a depth approximately two feet lower than the water flow line, in a six foot radius around the structure. The sump will 'catch' and settle silt so that it does not settle within the structure, which causes blockage and intensive maintenance. Sumps will be cleared on a rotating basis, so that 25% of the sumps will be cleared each year and every fourth year thereafter. A schedule of maintenance and mapped locations are included in Appendix

Several sections of the main ditch and all field ditches are scheduled for rehabilitation, as explained earlier in this plan. Once rehabilitated, it is important that the ditches be maintained on a cyclical basis to assure optimum water flow. Ditches will be maintained in the same way as WCS sumps, with 25% of the main ditch and all field ditches being maintained each year and every four years thereafter.

A schedule of maintenance and mapped locations of the ditches are included in Appendix C.

2. Soil Disturbance

In order to provide optimum production of preferred vegetation in moist soil areas, some disturbance of the soils is necessary on a cyclical basis. At Clarence Cannon NWR, water can be manipulated in a timely manner to aid production of preferred vegetation, but is not enough to control unpreferred vegetation. Soil disturbance, primarily by disking to a depth of at least eight inches, can assure this control.

Presently, cyclical soil disturbance can be accomplished by refuge personnel utilizing a John Deere 2640 tractor and an eight foot offset disc. However, as development of new moist soil areas increases total moist soil acreage, the amount of soil disturbance required will be too much for refuge personnel to accomplish in a cost effective manner.

Soil disturbance will be carried out in conjunction with the cooperative farm program. Each year beginning 1985, one-fourth of all moist soil areas will be planted to corn or milo by the cooperative farmer. The cooperative farmer will be limited to the use of broad-leaf herbicides only. One-third share of all crops shall remain standing in these units and the farmer may harvest the remainder. These units will be allowed to reflood naturally via capture of precipitation, and will provide standing water and food for spring migrants. The cropping rotation is as follows:

<u>YEAR</u>	<u>SPRING</u>	<u>SUMMER</u>	<u>FALL</u>
1	flooded	dry	flooded
2	flooded	dry	flooded
3	flooded	dry	flooded
4	corn/milo	harvest	dry
5	flooded	dry	flooded
6	flooded	dry	flooded
7	flooded	dry	flooded
8	corn/milo	harvest	dry

Accomplishment of soil disturbance via cooperative farming will allow us to provide 1,135 acres standing water in fall and 380 acres in spring meeting objectives specified in Management Strategies.

3. Vegetation Control

After rehabilitation of dikes and levees is accomplished, maintenance of these facilities primarily requires timely vegetation control. Exceptions to this would include required maintenance/repair of wave action and flood damage. This will be accomplished on an 'as needed' basis.

Maintenance of optimum vegetation on dikes and levees should provide protection against erosion problems. Optimum vegetation on dikes and levees on Clarence Cannon NWR includes primarily cool-season grasses such as prairie cordgrass, reed canary grass, and fescue.

To promote preferred grass growth and control undesirable woody plants and forbs, a cyclical maintenance program of prescribed burning and mowing is planned.

Prescribed burning, conducted in early spring, controls undesirable species and removes duff that may retard good grass stands. Burning of dikes and levees on an annual basis is described in the refuge Prescribed Burning Plan.

All dikes and levees shall be mowed annually to control new growth of undesirable plants and promote grasses. Mowing shall be conducted after the major nesting period for waterfowl and upland game, usually between April 1 and July 20. Clump grasses shall not be mowed to allow seed production, wildlife cover, and erosion control.

Mowing of rank vegetation within MSU's will also be done to provide open water and travel lanes for waterfowl. Areas will be mowed in an irregular pattern at the manager's discretion, depending upon vegetation type and density.

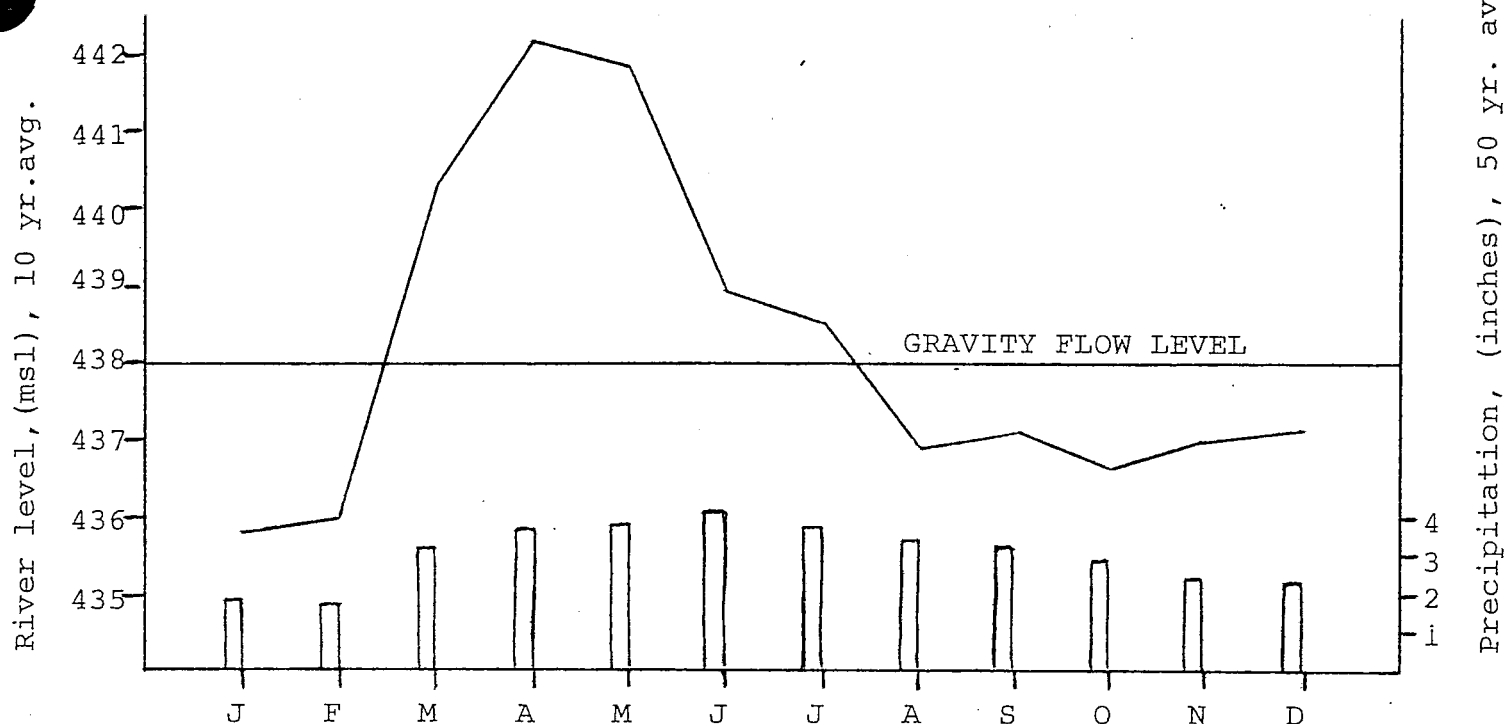
MANAGEMENT STRATEGIES

General management strategies for Clarence Cannon National Wildlife Refuge are designed to increase waterfowl maintenance levels and production while at the same time meeting objectives for: a) other migrant species, b) threatened species maintenance, and c) resident wildlife maintenance and production. Optimum water management on Clarence Cannon National Wildlife Refuge is gained through the completion of all rehabilitation, development, and maintenance projects covered in this plan, and an integrated approach toward water manipulation that advantageously affects all wildlife use on the refuge. This section deals with water manipulation on the refuge and gives a general schedule of events which serves as a basic plan for refuge management to follow. It is expected that refuge management personnel will amend the plan on an annual basis in relation to varying weather and water conditions, vegetative responses, and wildlife use.

On Clarence Cannon National Wildlife Refuge, water is supplied to managed units by utilizing a 20,000 g.p.m. pump that pulls water from a diversion channel (Bryants Creek) of the Mississippi River. Gravity flow is not usually possible for bringing water into the refuge when it is needed due to insufficient river levels. Water is removed from the refuge by utilizing two 20,000 g.p.m. pumps or gravity. Due to perennial high river levels between March 1 and July 1, gravity is usually not a viable option for removing water during this period.

Water is diverted into the main ditch system from which all units except Goose Pasture MSU are gravity filled. A Crisafulli pump is required to fill Goose Pasture MSU because of its higher elevation. Gravity filling of all MSUs requires backfilling and maintaining water in the main ditch to 441.5 feet m.s.l. A series of eight water control structures (five of which exist in place) in the main ditch system allow for optimum energy utilization to fill MSUs, i.e., only sections of the main ditch are filled to 441.5 m.s.l. at any one time. All MSUs can be drained if the main ditch water level is maintained below 438 feet m.s.l.

Table C.3. Monthly precipitation, average river levels, and gravity flow level requirements for Clarence Cannon NWR, Oct. 1984.



As indicated in Table C.3., pumping is required to fill moist soil units prior to the fall migration period. Timely precipitation in the form of heavy thundershowers can lessen fall pumping requirements, and for this reason, all MSU's planned for fall flooding are sealed off of the main ditch system in mid-August to trap rainwater.

Sections of the main ditch system can be sealed in a like manner, if they don't adversely affect rehabilitation and maintenance projects still in progress.

It is estimated that 1.35 gallons of fuel are required to pump one acre foot of water with the pump running at 20,000 g.p.m. Over the past five years, an average of 900 gallons of fuel has been required to fill moist soil units in the fall. With ditch rehabilitation and new development, pumping requirements will increase by an estimated 500 gallons of fuel, for an average fall pumping total of 1,400 gallons of fuel.

Because of crop production in 25% of all MSUs each year, only 1,136 acres of moist soil areas will require filling through pump operation. MSU's will be filled slowly over a two to three week period, requiring several short periods of pump operation. MSU's are filled at the manager's discretion, who bases his decisions on arrival of migrant species. The annual water management plan shall prescribe a schedule for filling MSUs so that the process continues throughout the migration period, i.e., all MSU's are not flooded at the same time.

Considering pumping requirements, fuel costs; and the Service's commitment to energy conservation, dewatering of the refuge by pumping must be avoided. Dewatering of managed units can be completed by gravity while still meeting management objectives by draining the main ditch and 70% of the green tree reservoirs prior to March 1. This will provide the capacity for dewatering of moist soil units as prescribed by the annual water management plan.

Water from mid-season drawdowns can be held in sections of the main ditch until it is possible to resume gravity flow, sometime after mid-June. This additional water will serve primarily as loafing habitat and early brood rearing areas by ducks and feeding areas for wading birds.

In order to increase duck use days, preferred natural food production and standing water must be increased. Nesting habitat must be increased to provide greater production of mallard and teal and brood water must be provided into the summer months.

A schedule for water manipulation is presented in the following text that should provide substantial increase in both management objectives.

This program will also enhance management objectives for goose maintenance, other migratory maintenance, and resident wildlife maintenance levels. Threatened species maintenance, increasing annually over the past five year period, will also benefit from this management.

Twenty-five percent of all MSU's will be drawn down prior to March 1 to dry the soil for disturbance and to provide the main ditch greater drainage capacity for other MSUs and excessive precipitation. The early drawdown will provide mudflats for utilization by other migratory species, primarily shorebirds, in the spring. Once dry, these units will be planted to corn or milo according to the cooperative farm agreement, providing soil disturbance with no cost to the refuge. The farmer will be allowed to harvest his share of the crop, after which the MSU will be sealed in order to trap precipitation. This method of soil disturbance will provide a) an additional fall food source for waterfowl, b) spring loafing water for waterfowl, c) excellent substrate for production of invertebrates to be utilized by wading birds in the early spring.

These units will be drawn down slowly (two to three week period) after June 1. Due to disturbance the preceding year and a mid-season drawdown date, production of millet, giant foxtail, and some smartweed is expected in these units.

Twenty-five percent of all MSUs will be drawn down slowly after July 1. The later drawdown date for these MSUs should provide loafing habitat for waterfowl, brood habitat for waterfowl, and feeding habitat for other migrant species, primarily wading birds. Vegetative response is expected to include millets, smartweed, rice cutgrass, and crabgrass among others. Late drawdowns should be limited to MSUs that are scheduled to receive soil disturbance for the following year so that established perennial vegetation provides an optimum substrate for production of invertebrates and cover for duck broods and nesting rails.

The remaining 50% of all MSUs will be slowly drawn down either early (prior to March 1) or mid-season (March 1 - July 1). Early draw down will allow an earlier vegetation response. This will increase seed production of species including giant foxtail, smartweed, millets, and beggarticks. It will also provide fair nesting habitat for mallard and teal. Having access to nesting areas other than dikes and levees, where the majority of nesting now occurs, will increase

production of mallards and teal by getting them away from major runways of predators.

A mid-season drawdown date will provide additional habitat for loafing waterfowl. Vegetative response is expected to produce millets, smartweed, crabgrass, and beggarticks.

Slow drawdown will provide a constant source of invertebrates for utilization by all species, both directly and indirectly, via mudflats and receding water.

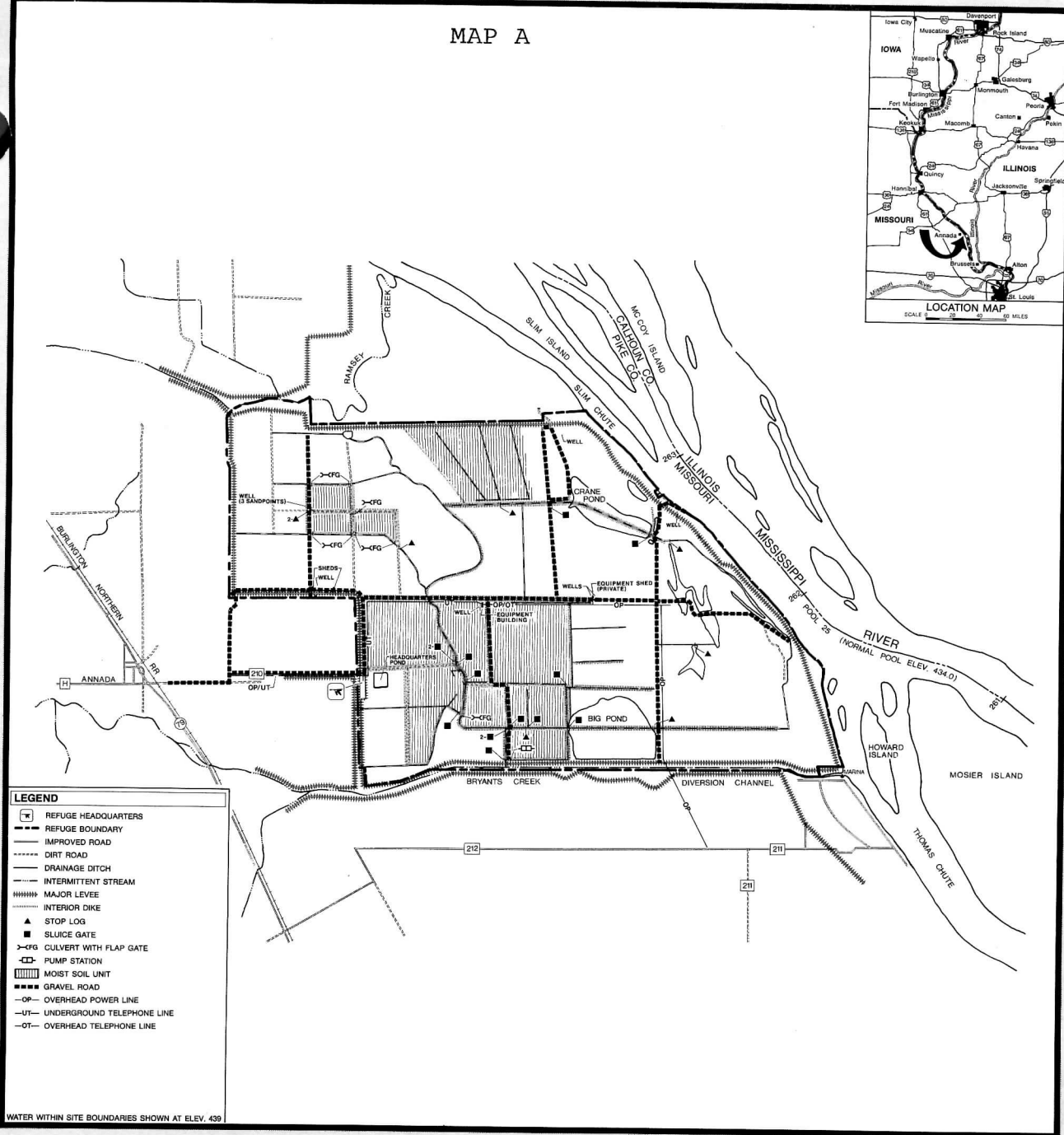
Green tree reservoirs will be drained as soon as possible (60% by March 1) in order to enhance tree growth and mast production. Green tree reservoirs and other timbered lands contain several low areas that hold water well into the summer, providing brood habitat for wood ducks.

MSUs will be flooded to an average depth not exceeding one foot. Topography is such in all MSUs that this will provide varying water depths in each MSU attractive to many wildlife species. Water depths will run from depths of three feet utilized by divers and coots, to sheetwater less than two inches deep utilized by teal, mallards, and a great variety of shorebirds, herons, and gulls.

APPENDIX A

MAPS

MAP A



EXISTING DEVELOPMENT/ROAD & UTILITY CLARENCE CANNON N.W.R.

MARK TWAIN NATIONAL WILDLIFE REFUGE
U.S. FISH AND WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

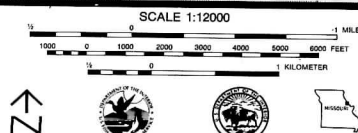
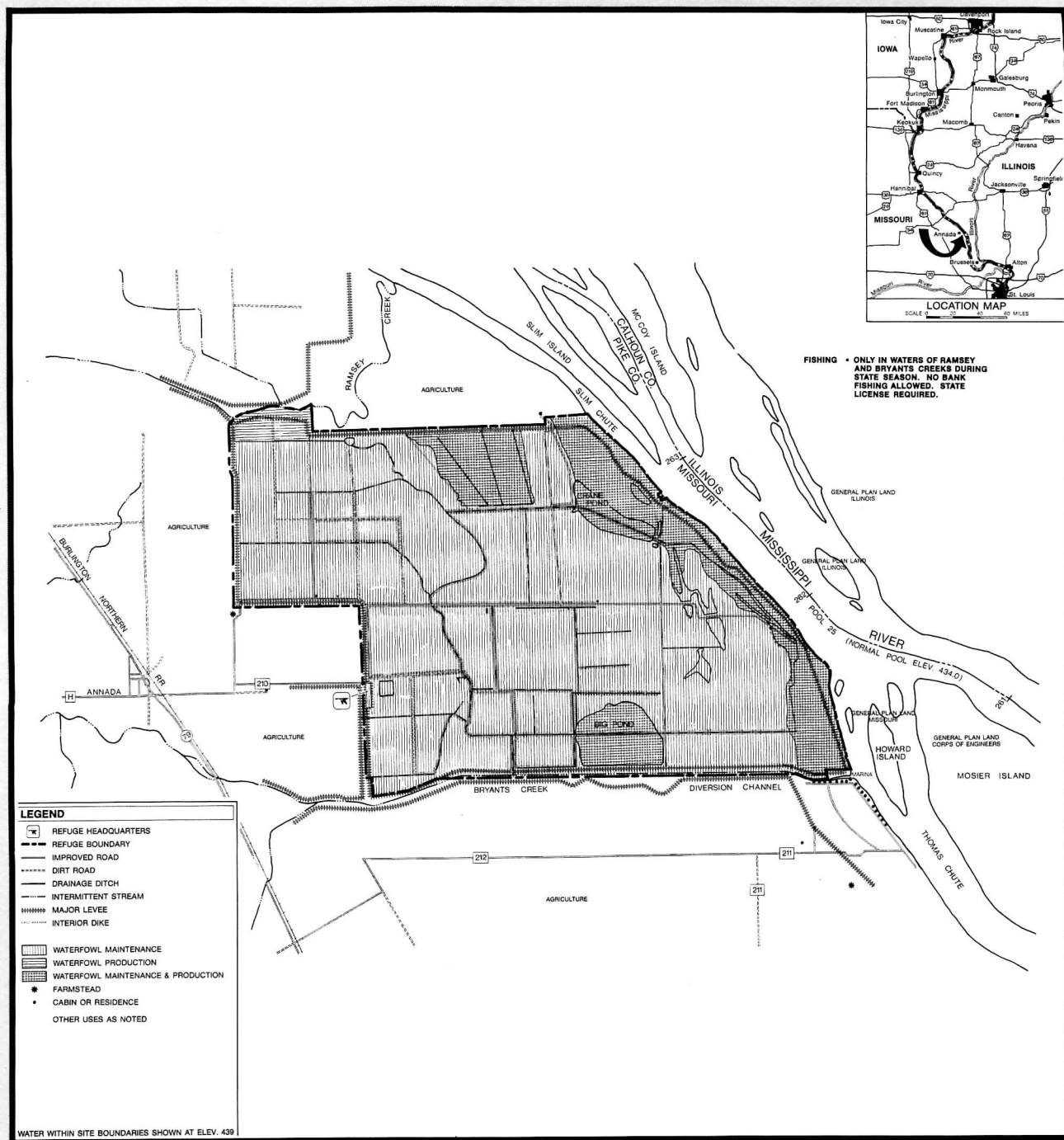


FIGURE 58



EXISTING LAND USE

CLARENCE CANNON N.W.R.

MARK TWAIN NATIONAL WILDLIFE REFUGE

U.S. FISH AND WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

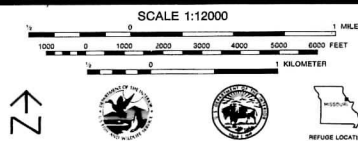
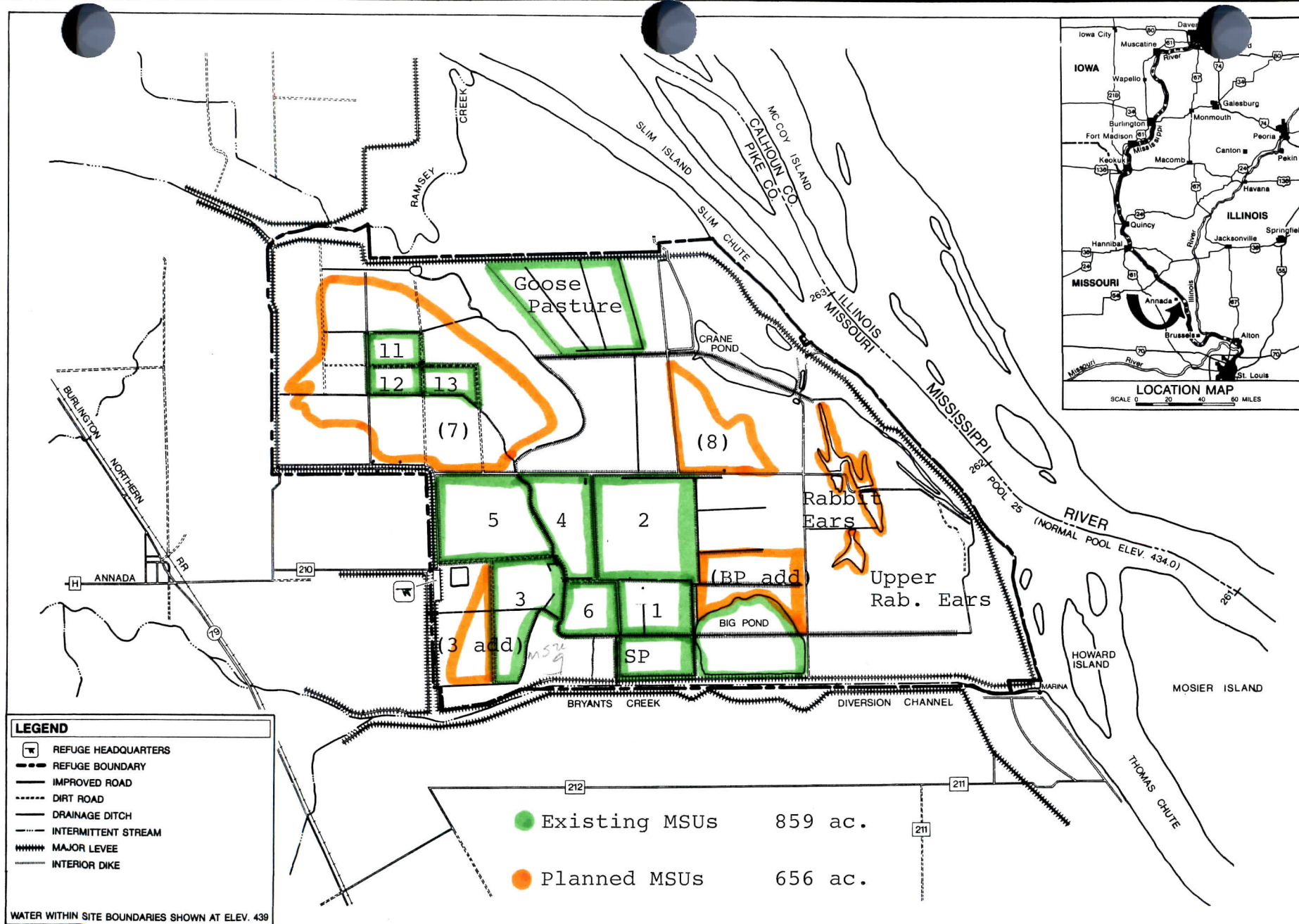


FIGURE 59

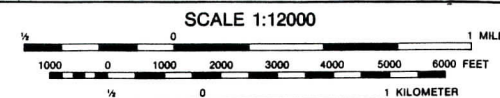


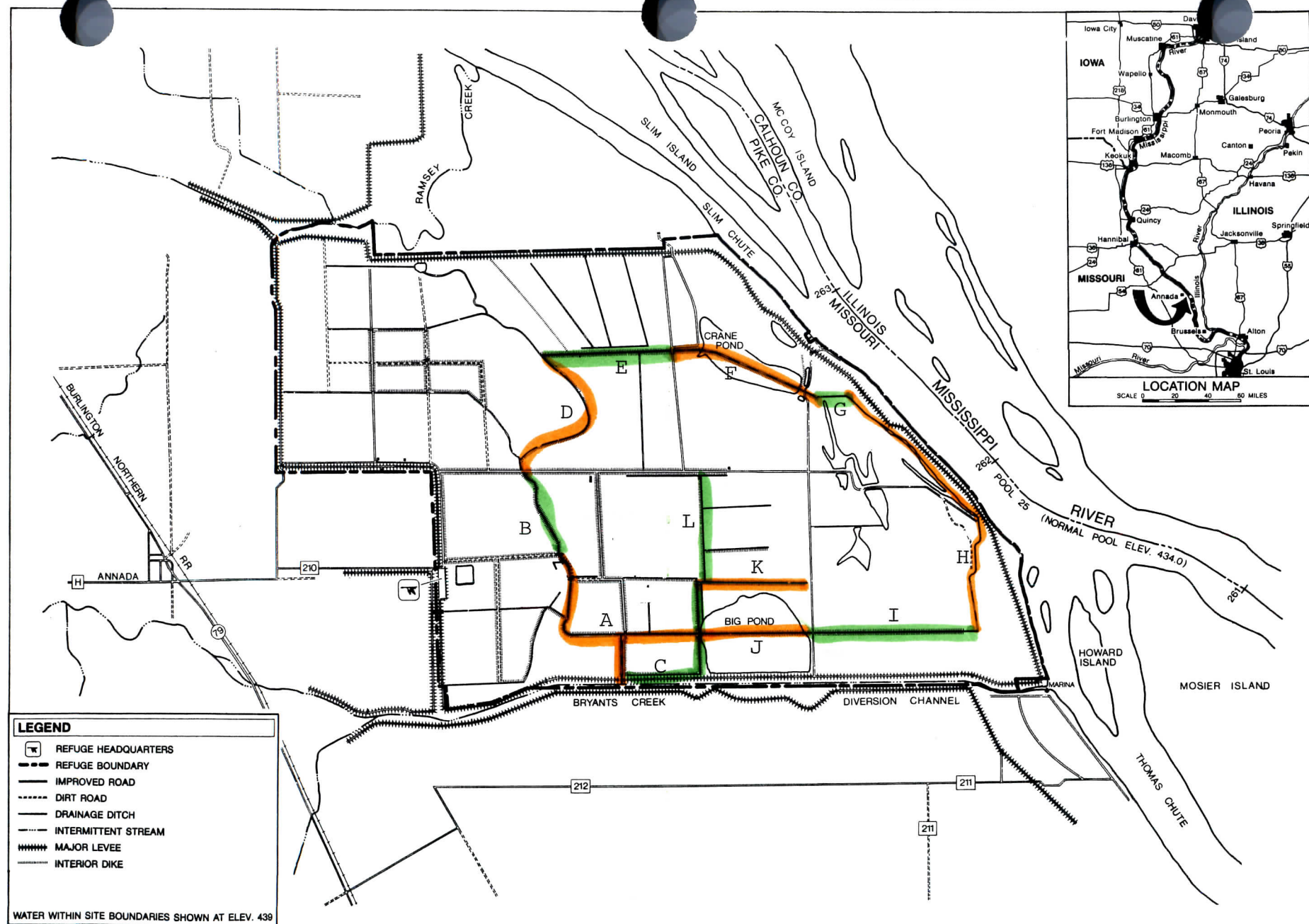
MOIST SOIL UNIT DEVELOPMENT

CLARENCE CANNON N.W.R.

MARK TWAIN NATIONAL WILDLIFE REFUGE

U.S. FISH AND WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR





- LEGEND**
- REFUGE HEADQUARTERS
 - REFUGE BOUNDARY
 - IMPROVED ROAD
 - DIRT ROAD
 - DRAINAGE DITCH
 - INTERMITTENT STREAM
 - MAJOR LEVEE
 - INTERIOR DIKE

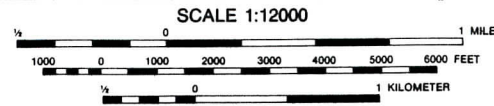
WATER WITHIN SITE BOUNDARIES SHOWN AT ELEV. 439

SECTIONAL DELINEATION - MAIN DITCH

CLARENCE CANNON N.W.R.

MARK TWAIN NATIONAL WILDLIFE REFUGE

U.S. FISH AND WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR





REFUGE DEVELOPMENT PLAN

CLARENCE CANNON N.W.R.

MARK TWAIN NATIONAL WILDLIFE REFUGE

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DEPARTMENT OF THE INTERIOR





SCHEDULE FOR MSU SOIL DISTURBANCE

CLARENCE CANNON N.W.R.

MARK TWAIN NATIONAL WILDLIFE REFUGE

U.S. FISH AND WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR



APPENDIX B

SCHEDULE OF PROJECTS
PROJECT PRIORITY LISTING

MARSH AND WATER MANAGEMENT PLAN

PRIORITY LISTING OF MANAGEMENT PROJECTS

Project Description	Code	Priority Sequence	Cost Thous.\$	Staff Days	CY Completion
Rehab East Levee	REHAB	R-1	90.0	10	1986
Rehab South Levee	REHAB	R-2	1.4	12	1985
Rehab Section E, Main Ditch	REHAB	R-3	1.1	10	1985
Rehab Section D, Main Ditch	REHAB	R-4	2.2	18	1985
Rehab Section L, Main Ditch	REHAB	R-5	.7	7	1985
Rehab Sections F,G, Main Ditch	REHAB	R-6	70.0	10	1986
Rehab Section C, Main Ditch	REHAB	R-7	1.8	18	1987
Rehab Section J, Main Ditch	REHAB	R-8	1.0	9	1984
Rehab Section I, Main Ditch	REHAB	R-9	1.8	15	1987
Rehab Section K, Main Ditch	REHAB	R-10	1.3	11	1986
Rehab Field Ditches	REHAB	R-11 12 13 14	1.9	20	25% per year
TOTAL PROJECTS - 14	REHAB		177.9	120	
Develop MSU 7	DEVELOP	D-1	2.2	18	1985
Develop MSU 3 Addition	DEVELOP	D-2	1.4	10	1986
Develop Rabbit Ears Marsh	DEVELOP	D-3	.9	7	1987
Develop Upper Rabbit Ears Marsh	DEVELOP	D-4	.3	2	1987
Develop Big Pond Addition	DEVELOP	D-5	1.7	9	1988
Develop MSU 8	DEVELOP	D-6	8.6	19	1989
TOTAL PROJECTS - 6	DEVELOP		15.1	65	

MARSH AND WATER MANAGEMENT PLAN

PRIORITY LISTING OF MANAGEMENT PROJECTS

Project Description	Code	Priority Sequence	Cost Thous.\$	Staff Days	CY Completion
ALL CYCLICAL MAINTENANCE PROJECTS RECEIVE SAME PRIORITY, AND ARE COMPLETED EACH YEAR. AS REHABILITATION AND DEVELOPMENT PROJECTS ARE COMPLETED, CYCLICAL MAINTENANCE WILL INCREASE.					
Prescribed burning	CYC MAINT	-	1.7	20	annually
Mow dikes/levees	CYC MAINT	-	2.3	20	annually
Sump 25% WCS's	CYC MAINT	-	1.4	10	annually
Mow selected MSU's	CYC MAINT	-	.9	10	annually
Soil Disturbance	CYC MAINT	-	0	0	annually by coop. farmer
Paint WCS's	CYC MAINT	-	.8	YCC	1986
TOTAL PROJECTS - 6	CYC MAINT		6.3	60	annually

TOTAL PROJECTS - 26	REHAB DEVELOP CYC MAINT		225.3	425	

3-722

SELECTED MAINTENANCE AND REHABILITATION PROJECTS FY85
(See reverse for instructions)

OFFICE NAME: Clarence Cannon NWRDATE: Oct. 1984 BY: _____

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Project Name	W.E. Code	Fund Sources Sub- activity	Method FA or C	Est. Total Cost \$	Materials Manpower On Hand \$	Add'l. Cost \$	Eng X Needed	Remarks	Staff Days
Prescribed Burning	229	1260	FA	1712.48	1712.48	0	No	Cyc. Maint.	20
Mow Water Mgmt. Facilities	737	1260	FA	2256.00	2256.00	0	No	Cyc. Maint.	20
Rehab South Levee	737	1260	FA	1422.88	1422.88	0	No	Rehab	12
Rehab Section E Main Ditch	737	1260	FA	1087.20	1087.20	0	No	Rehab	10
Rehab Section D Main Ditch	737	1260	FA	2167.52	2167.52	0	No	Rehab	18
Develop MSU 7	731	1260	FA	2230.32	2230.32	0	No	Development	18
Rehab Section J Main Ditch	737	1260	FA	1017.96	1017.96	0	No	Rehab	9
Soil Disturbance	--	--	Other	--	--	0	No	Cyc. Maint.	Coop Farming
Rehab 25% Field Ditches	737	1260	FA	1904.80	1904.80	0	No	Rehab	20
Sump 25% WCSs	737	1260	FA	1350.40	1350.40	0	No	Cyc. Maint.	10
Rehab Section L Main Ditch	737	1260	FA	747.88	747.88	0	No	Rehab	7
Mow Selected MSU's	731	1260	FA	900.40	900.40	0	No	Cyc. Maint.	10
TOTAL 12 PROJECTS				16,797.84	16,797.84	0			154

SELECTED MAINTENANCE AND REHABILITATION PROJECTS FY86
(See reverse for instructions)

OFFICE NAME: Clarence Cannon NWRDATE: Oct. 1984 BY: _____

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Project Name	W.E. Code	Fund Sources Sub- activity	Method FA or C	Est. Total Cost \$	Materials Manpower On Hand \$	Add'l. Cost \$	Eng X Needed	Remarks	Staff Days
Prescribed Burning	229	1260	FA	1712.48	0	0	No	Cyc. Maint.	20
Mow Water Mgmt. Facilities	737	1260	FA	2256.00	0	0	No	Cyc. Maint.	20
Rehab Sections F,G, Main Ditch	737	1260	C	70,000.00		70,000.00	Yes	Rehab	10
Rehab East Levee	737	1260	C	90,000.00		90,000.00	Yes	Rehab	10
Rehab Section K Main Ditch	737	1260	FA	1288.00	1288.00	0	No	Rehab	11
Soil Disturbance	--	--	Other	--	--	0	No	Cyc. Maint.	Coop Farming
Rehab 25% of Field Ditches	737	1260	FA	1904.80	1904.80	0	No	Rehab	20
Sump 25% WCSS	737	1260	FA	1350.40	1350.40	0	No	Cyc. Maint.	10
Develop MSU 3 Addition	731	1260	FA	1350.40	1350.40	0	No	Development	10
Mow Selected MSU's	731	1260	FA	900.40	900.40	0	No	Cyc. Maint.	10
TOTAL 10 PROJECTS				170,762.48	170,762.48	160,000.00			121

SELECTED MAINTENANCE AND REHABILITATION PROJECTS FY 87
 (See reverse for instructions)

OFFICE NAME: Clarence Cannon NWRDATE: Oct. 1984 BY: _____

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Project Name	W.E. Code	Fund Sources Sub- activity	Method FA or C	Est. Total Cost \$	Materials Manpower On Hand \$	Add'l. Cost \$	Eng X Needed	Remarks	Staff Days
Prescribed Burning	229	1260	FA	1712.48	1712.48	0	No	Cyc. Maint.	20
Mow Dikes/Levees	737	1260	FA	2256.00	2256.00	0	No	Cyc. Maint.	20
Rehab Section C Main Ditch	737	1260	FA	1778.32	1778.32	0	No	Rehab	18
Rehab Section I Main Ditch	737	1260	FA	1762.40	1762.40	0	No	Rehab	15
Soil Distrubance	--	--	Other	--	--	0	No	Cyc. Maint.	Coop Farming
Rehab 25% Field Ditches	737	1260	FA	1904.80	1904.80	0	No	Rehab	20
Sump 25% WCSs	737	1260	FA	1350.40	1350.40	0	No	Cyc. Maint.	10
Develop Rabbit Ears Marsh	731	1260	FA	891.70	891.70	0	No	Development	7
Develop Upper Rabbit Ears Marsh	731	1260	FA	270.08	270.08	0	No	Development	2
Mow Selected MSU's	731	1260	FA	900.40	900.40	0	No	Cyc. Maint.	10
TOTAL 10 PROJECTS				12826.58	12826.58	0			122

3-722

SELECTED MAINTENANCE AND REHABILITATION PROJECTS FY87
(See reverse for instructions)

OFFICE NAME: Clarence Cannon NWRDATE: Oct. 1984 BY: _____

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Project Name	W.E. Code	Fund Sources Sub- activity	Method FA or C	Est. Total Cost \$	Materials Manpower On Hand \$	Add'l. Cost \$	Eng X Needed	Remarks	Staff Days
Prescribed Burning	229	1260	FA	1712.48	1712.48	0	No	Cyc. Maint.	20
Mow Dikes/Levees	737	1260	FA	2256.00	2256.00	0	No	Cyc. Maint.	20
Soil Disturbance	--	--	Other	--	--	0	No	Cyc. Maint.	Coop Farming
Rehab 25% Field Ditches	737	1260	FA	1904.80	1904.80	0	No	Rehab	20
Sump 25% WCSs	737	1260	FA	1350.40	1350.40	0	No	Cyc. Maint.	10
Develop Big Pond Addition	737	1260	FA	1745.06	1135.06	610.00	No	Development	9
Mow Selected MSUs	731	1260	FA	900.40	900.40	0	No	Cyc. Maint.	10
Maintain Sections A,B, Main Ditch	737	1260	FA	1350.40	1350.40	0	No	Cyc. Maint.	10
TOTAL 8 PROJECTS				10,609.54	9,999.54	610.00			99

3-722

SELECTED MAINTENANCE AND REHABILITATION PROJECTS FY 89
(See reverse for instructions)

OFFICE NAME: Clarence Cannon NWRDATE: Oct. 1984 BY: _____

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Project Name	W.E. Code	Fund Sources Sub- activity	Method FA or C	Est. Total Cost \$	Materials Manpower On Hand \$	Add'l. Cost \$	Eng X Needed	Remarks	Staff Days
Prescribed Burning	229	1260	FA	1712.48	1712.48	0	No	Cyc. Maint.	20
Mow Dikes/Levees	737	1260	FA	2256.00	2256.00	0	No	Cyc. Maint.	20
Soil Disturbance	--	--	Other	--	--	0	No	Cyc. Maint.	Coop Farming
Maintain 25% Field Ditches	737	1260	FA	1904.80	1904.80	0	No	Cyc. Maint.	20
Sump 25% WCSS	737	1260	FA	1350.40	1350.40	0	No	Cyc. Maint.	10
Maintain Sections E,D,J,L	737	1260	FA	2025.60	2025.60	0	No	Cyc. Maint.	15
Develop MSU 8	731	1260	FA	8613.76	2333.76	6280.00	No	Development	19
TOTAL 10 PROJECTS				17863.04	11583.04	6280.00			104

3-722

SELECTED MAINTENANCE AND REHABILITATION PROJECTS FY90
(See reverse for instructions)

OFFICE NAME: Clarence Cannon NWRDATE: Oct. 1984 BY: _____

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Project Name	W.E. Code	Fund Sources Sub- activity	Method FA or C	Est. Total Cost \$	Materials Manpower On Hand \$	Add'l. Cost \$	Eng X Needed	Remarks	Staff Days
Prescribed Burning	229	1260	FA	1712.48	1712.48	0	No	Cyc. Maint.	20
Mow Dikes/Levees	737	1260	FA	2256.00	2256.00	0	No	Cyc. Maint.	20
Soil Disturbance	--	--	Other	--	--	0	No	Cyc. Maint.	Coop Farming
Maintain 25% Field Ditches	737	1260	FA	1904.80	1904.80	0	No	Cyc. Maint.	20
Sump 25% WCSs	737	1260	FA	1350.40	1350.40	0	No	Cyc. Maint.	10
Maintain Sections F,G,K, Main Ditch	737	1260	FA	1620.48	1620.48	0	No	Cyc. Maint.	12
Mow Selected MSUs	731	1260	FA	900.40	900.40	0	No	Cyc. Maint.	10
TOTAL 10 PROJECTS				9744.56	9744.56	0			92

APPENDIX C

PROJECT DESCRIPTIONS/COST ANALYSIS

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR

Project Code Rehabilitation

IPW# CAN/0001

Project Description Rehabilitation East Levee

Priority Sequence R 1

Funding Contract

Completion Date 1986

Project Summary:

Repair erosion damage, remove trees and brush from levee slopes, reseed w/grass. Project covers approx. 2 miles, which includes the entire east levee.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Funding scheduled for FY 86					
Job Order required.					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR Project Code Rehabilitation
 IPW#

Project Description Rehabilitation South Levee

Priority Sequence R 2 Funding FA Completion Date 1985

Project Summary:

Reconstruct south levee to 449.5 m.s.l. on two sections totalling .3 miles. Reseed .3 miles reconstructed area.

Cost Analysis:

Type of Cost	Staff Days *	Cost	Supplies/ Equipment	Cost	Total Cost
Reconstruct .3 miles	10	\$702.40	IH 806 Tractor 1 yd. scraper	\$50 \$0	\$752.40
Seed .3 miles	2	\$140.48	J.D. 2020 Broadcast Seeder Seed Fertilizer Disc	\$30 \$0 \$300 \$200 \$0	\$670.48
TOTAL	12	\$842.88		\$580	\$1422.88
*Tractor Operator					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR Project Code Rehabilitation
 IPW# _____
 Project Description Ditch Rehab - Main Section E
 Priority Sequence R 3 Funding FA Completion Date 1985

Project Summary:

Clean out woody vegetation, silt, and debris from main ditch. Requires removal of 0.6 acres timber to 14" DBH on east edge of ditch to allow access by dragline. Depth of siltation averages 2-3 feet; water flow line will be surveyed during project execution. Ditch will be cleaned out from north side. Spoil will be placed north of ditch.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Clear .6 acres timber from ditch spoil	2 ^A	\$190.08	D-8 Dozer	\$80.00	\$270.08
Clean out main ditch (0.56 miles)	4 ^A	\$380.16	American Crane	\$160.00	\$540.16
Survey water flow line	4 ^B	\$276.96	Dumpy Level, Survey Rod, Hand-held Radios	--	\$276.96
TOTAL	10	\$847.20		\$240.00	\$1,087.20
A - Maintenance Mechanic					
B - Ass't. Refuge Manager and Tractor Operator					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR Project Code Rehabilitation

IPW# N/A

Project Description Ditch Rehabilitation - Main Section D

Priority Sequence R 4 Funding FA Completion Date 1985

Project Summary:

Clean out woody vegetation, silt, and debris from 0.75 miles section of main ditch. Requires site preparation and clearing to allow access by American Crane. Southern 2/3 of ditch to be cleaned out from east side, northern 1/3 from west side. Requires removal of 2-3' silt--- water flow line will be determined by survey during project execution.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Clear 1.8 ac. timber adjacent to ditch	6 ^A	570.24	D-8 Dozer	\$240.00	\$810.24
Clean out 0.75 miles main ditch	8 ^A	760.32	American Crane	\$320.00	\$1080.32
Survey water flow line	4 ^B	276.96	Dumpy level, survey rod, hand-held radios	--	\$276.00
TOTAL	18	1607.52	--	\$560.00	\$2167.52
A - Maintenance Mechanic					
B - Ass't. Refuge Manager and Tractor Operator					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR

Project Code Rehabilitation

IPW# _____

Project Description Ditch Rehabilitation - Main Section L

Priority Sequence R 5

Funding FA

Completion Date 1985

Project Summary:

Clean out woody vegetation, silt and debris from .5 mile section of main ditch. Project can be completed using D-8 dozer. Wood debris will be stacked for burning in ag field adjacent. Requires survey of water flow line during project execution.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Clean out .5 mile main ditch	4 ^A	\$380.16	D-8 Dozer	\$760.00	\$540.16
Survey water flow line	3 ^B	\$207.72	Level, rod, radios	--	\$207.72
TOTAL	7	\$587.88	--	\$160.00	\$747.88
A - Maintenance Mechanic					
B - Ass't. Refuge Manager and Tractor Operator					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR

Project Code Rehabilitation

IPW# CAN/0015

Project Description Ditch Rehabilitation - Main Sections F, G

Priority Sequence R 6 Funding Contract Completion Date 1986

Project Summary:

Clean out woody vegetation, silt, and debris from 0.8 miles section of main ditch. Requires site preparation and clearing to allow access. Ditch will be cleared from south side.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Funding scheduled for FY 86 Job Order required.					70,000

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR

Project Code Rehabilitation

IPW# _____

Project Description Ditch Rehabilitation - Main Section C

Priority Sequence R 7

Funding FA

Completion Date 1987

Project Summary:

Clean out of woody vegetation, silt, and debris from 0.50 mile main ditch section. Partial clearing of trees from north and west side of ditch can be accomplished with D-8 dozer. Requires removal of 2-3' silt---water flow line will be determined by survey during project execution. Some trees may have to be removed with chain saw.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Clean trees over 14" DBH	8 ^A	\$661.12	Chain saws	\$30.00	\$691.12
Clean out 0.5 mile main ditch	6 ^B	\$570.24	D-8 dozer American crane	\$240.00	\$810.24
Survey water flow lines	4 ^C	\$276.96	Level, rod, radios	---	\$276.96
TOTAL	18	\$1,508.32	---	\$270.00	\$1,778.32
A - Maintenance Mechanic and Tractor Operator B - Maintenance Mechanic C - Ass't. Refuge Manager and Tractor Operator					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR Project Code Rehabilitation
 IPW# _____
 Project Description Ditch Rehabilitation - Main Section J
 Priority Sequence R 8 Funding FA Completion Date 1984

Project Summary:

Clean out woody vegetation, silt, and debris from 0.5 miles of section main ditch. Requires site preparation and clearing of spoil to allow access by American crane. Ditch to be cleaned out from north side. Requires removal of 2-3' of silt---water flow line will be determined by survey during project execution.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Clear 1 mile spoil both sides of ditch	3 ^A	\$285.12	D-8 dozer	\$120.00	\$405.12
Clean 0.50 miles main ditch	3 ^A	\$285.12	American dragline	\$120.00	\$405.12
Survey water flow line	3 ^B	\$207.72	Level, rod, radios	---	\$207.72
TOTAL	9	\$777.96	---	\$240.00	\$1,017.96
A - Maintenance Mechanic B - Ass't. Refuge Manager and Tractor Operator					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR Project Code Rehabilitation

IPW# N/A

Project Description Ditch Rehabilitation - Main Section I

Priority Sequence R 9 Funding FA Completion Date 1987

Project Summary:

Clean out woody vegetation, silt, and debris from 0.68 miles section of main ditch. Requires site preparation and clearing of medium to heavy timber from north side of ditch to allow access by American crane. Requires survey of water flow line during project execution.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Clear 1.7 acres med. to heavy timber/brush from north side of ditch	5 ^A	\$475.20	D-8 dozer	\$200.00	\$675.20
Clean out .68 miles main ditch	6 ^A	\$570.24	American crane	\$240.00	\$810.24
Survey water flow line	4 ^B	\$276.96	Level, rod, radios	---	\$276.96
TOTAL	15	\$1,322.40	---	\$440.00	\$1,762.40
A - Maintenance Mechanic					
B - Ass't. Refuge Manager and Tractor Operator					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR Project Code Rehabilitation
 IPW#

Project Description Ditch Rehabilitation - Main Section K

Priority Sequence R 10 Funding FA Completion Date 1986

Project Summary:

Clean out woody vegetation, silt and debris from 0.50 miles section of main ditch. Requires site preparation and clearing of medium to heavy timber from south side of ditch to allow access by American crane. Requires survey of water flow line during project execution.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Clear 0.90 ac. timber/brush from south side of ditch	4 ^A	\$380.16	D-8 dozer	\$160.00	\$540.16
Clean out 0.50 miles main ditch	4 ^A	\$380.16	American crane	\$160.00	\$540.16
Survey water flow line	3 ^B	\$207.72	Level, rod, radios	---	\$207.72
TOTAL	11	\$968.04	---	\$320.00	\$1288.04
A - Maintenance Mechanic					
B - Assistant Refuge Manager and Tractor Operator					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR Project Code Rehabilitation

IPW#

Project Description Field Ditch Rehabilitation

Priority Sequence R 11 Funding FA Completion Date 1985

Project Summary:

Clean out 25% of all field ditches using IH 806 tractor and rotary ditcher.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Clean out 7.7 miles field ditches	20 ^A	\$1,404.80	IH 806 tractor, 1416 field ditcher	\$500.00	\$1,904.80
A - Tractor Operator					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR Project Code Rehabilitation

IPW# _____

Project Description Field Ditch Rehabilitation

Priority Sequence R 12 Funding FA Completion Date 1986

Project Summary:

Clean out 25% of all field ditches.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Clean out 7.25 miles field ditches	20 ^A	\$1404.80	IH 806 tractor, 1416 field ditcher	\$500.00	\$1904.80
A - Tractor Operator					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR Project Code Rehabilitation
IPW# _____

Project Description Field Ditch Rehabilitation

Priority Sequence R 13 Funding FA Completion Date 1987

Project Summary:

Clean out 25% of all field ditches.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Clean out 8 miles field ditches	20 ^A	\$1,404.80	IH 806 trac- tor, 1416 field ditcher	\$500.00	\$1,904.80
A - Tractor Operator					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR Project Code Rehabilitation

IPW#

Project Description Field Ditch Rehabilitation

Priority Sequence R 14 Funding FA Completion Date 1988

Project Summary:

Clean out 25% of all field ditches.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Clean out 2.6 miles field ditches	10 ^A	\$702.40	IH 806 tractor, 1416 field ditcher	\$250.00	\$772.40
Clean out 2.1 miles field ditches	11 ^B	\$1,045.44	American crane	\$440.00	\$1,485.44
Cleanout 1.0 mile field ditches	2 ^B	\$190.08	Cat-12 grader	\$80.00	\$270.08
TOTAL	23	\$1,937.92		\$770.00	\$2,707.92
A - Tractor Operator					
B - Maintenance Mechanic					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR

Project Code Development

IPW# _____

Project Description Develop MSU 7

Priority Sequence D 1

Funding FA

Completion Date 1985

Project Summary:

Develop 465 acres agricultural fields into moist soil unit in north-west area of refuge. Requires rehabilitation or construction of .37 mile ditch, terrace dike, ditch plug, and placement of three water control structures.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Rehabilitate .37 mile field ditch	3 ^A	\$285.12	American crane	\$120.00	\$405.12
Place 36" flashboard riser and 70' - 36" CMP in field ditch	3 ^B	\$244.92	American crane, D-8 dozer, 36" flashboard riser, 70' - 36" CMP	\$60.00	\$304.92
Place 48" screwgate and 72' - 48" CMP in main ditch north of 36" structure	3 ^B	\$244.92	American crane, D-8 dozer, 48" screwgate, 72' - 48" CMP	\$60.00	\$304.92
Construct terrace dike, southeast side	3 ^A	\$285.12	D-8 dozer	\$120.00	\$405.12
Extend 'W'-ditch 1000'	3 ^A	\$285.12	D-8 dozer	\$120.00	\$405.12
Place earthen ditch plug - north side	1 ^A	\$95.04	D-8 dozer	\$40.00	\$135.04
(continued)					

(continued from page 1)

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR Project Code Development

IPW#

Project Description Develop MSU 7

Priority Sequence D 1 Funding FA Completion Date 1985

Project Summary:

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Place 18" flapgate and 40'-18" CMP	2 ^A	\$190.08	Schild- Bantam, D-8 dozer, 18" flapgate, 40'-18" CMP	\$80.00	\$80.00
TOTAL	18	\$1630.32		\$600.00	\$2.230.32
A - Maintenance Mechanic					
B - Maintenance Mechanic and Ass't. Refuge Manager					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR

Project Code Development

IPW# _____

Project Description Develop MSU 3 Addition

Priority Sequence D 2

Funding FA

Completion Date 1986

Project Summary:

Develop 70 acre addition to existing MSU 3. Requires restructuring of MSU 3 west dike, placement of 2 - 70'-18" CMP culverts, rehabilitation of .62 mile field ditch.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Widen top and decrease slope angle of west dike - MSU 3	4 ^A	\$380.16	D-8 dozer, Cat 12 grader	\$160.00	\$540.16
Place 70'-18" CMP in north and south end-west dike	4 ^A	\$380.16	D-8 dozer, Schield-Bantam	\$160.00	\$540.16
Clean out .62 mile field ditch adjacent to west dike	2 ^A	\$190.08	Cat 12 grader	\$80.00	\$270.08
TOTAL	10	\$950.40		\$400.00	\$1350.40
A - Maintenance Mechanic					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR Project Code Development

IPW#

Project Description Provide Water Control - Rabbit Ears Marsh

Priority Sequence D 3 Funding FA Completion Date 1987

Project Summary:

Develop 20 acre Rabbit Ears Marsh into controlled MSU by placement of 18" screwgate and 70'-18" CMP and construction of two field ditches totalling 2,000 feet. Development can proceed only after rehabilitation of main ditch section G.

Cost Analysis: Development cost/acres gained = \$44.59

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Place 18" screwgate and 70'-18" CMP at junction w/main ditch	4 ^A	\$326.58	American crane	\$160.00	\$486.58
Construct field ditches	3 ^B	\$285.12	D-8 dozer	\$120.00	\$405.12
TOTAL	7	\$611.70		\$280.00	\$891.70
A - Maintenance Mechanic and Ass't. Refuge Manager					
B - Maintenance Mechanic					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR ; Project Code Development

IPW#

Project Description	Develop Upper Rabbit Ears Marsh
---------------------	---------------------------------

Priority Sequence D 4 Funding FA Completion Date 1987

Project Summary:

Develop 13 acre marsh into controlled MSU. Marsh already contains 24" flashboard riser w/60'-24" CMP. Requires restructuring of dike, levelling of three acres to provide drainage, and cleanout of 250 ft. field ditch.

Cost Analysis:

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Restructure 600 ft. dike	1 ^A	\$95.04	D-8 dozer	\$40.00	\$135.04
Level three acres land	.5 ^A	\$47.52	D-8 dozer	\$20.00	\$67.52
Cleanout 250 ft. field ditch	.5 ^A	\$47.52	D-8 dozer	\$20.00	\$67.52
TOTAL	2	\$190.08		\$80.00	\$270.08
A - Maintenance Mechanic					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR

Project Code Development

IPW# _____

Project Description Develop Big Pond Addition

Priority Sequence D 5

Funding FA

Completion Date 1988

Project Summary:

Development of 80 acre addition to Big Pond requires construction of .37 mile terrace dike adjacent to Big Pond road, replacement of 24" flapgate on west end of main ditch section K with 24" screwgate, placement of 24" flapgate w/30'-24" CMP on east end of section K ditch, and excavation of two drainage channels in ditch section K.

Cost Analysis: Development cost/acres gained = \$21.81

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Construct 0.37 mile terrace dikes	5 ^A	\$475.20	D-8 dozer, Cat 12 grader	\$200.00	\$675.20
Replace 24" flapgate w/30'-24" CMP	1 ^B	\$81.54	Schield-Bantam	\$40.00	\$121.54
Place 24" flapgate w/30'-24" CMP	2 ^B	\$163.28	Schield-Bantam, D-8 dozer, 24" flapgate, 30'-24" CMP	\$40.00 \$610.00	\$813.28
Excavate 2 drainage channels	1 ^A	\$95.04	D-8 dozer	\$40.00	\$135.04
TOTAL	9	\$815.06		\$930.00	\$1,745.06
A - Maintenance Mechanic					
B - Maintenance Mechanic and Ass't. Refuge Manager					

WATER MANAGEMENT PLAN (1984)

Project Area Clarence Cannon NWR Project Code Development

IPW#

Project Description Development MSU 8

Priority Sequence D 6 Funding FA Completion Date 1989

Project Summary:

Develop 65 acres agriculture fields into MSUs. Requires topographical survey, reconstruction of two roads totalling 1.13 miles, and placement of an 18" screwgate and 72'-18" CMP at north end of main ditch section L.

Cost Analysis: Development costs/acres gained = \$132.52

Type of Cost	Staff Days	Cost	Supplies/ Equipment	Cost	Total Cost
Topographic survey	2 ^A	\$138.28	Level, rod, radios	---	\$138.28
Raise 1.13 miles roads two feet	14 ^B	\$1330.56	D-8 dozer, Cat 12 grader 900 tons 1" minus road rock	\$560.00 \$5200.00	\$7090.56
Place 18" screwgate and 72'-18" CMP :	3 ^C	\$244.92	D-8 dozer, Schield-Bantam, 18" screwgate, 72'-18" CMP	\$60.00 \$1080.00	\$1384.92
TOTAL	19	\$1,713.76		\$6,900.00	\$8,613.76
A - Ass't. Refuge Manager and Tractor Operator					
B - Maintenance Mechanic					
C - Ass't. Refuge Manager and Maintenance Mechanic					

APPENDIX D

PLAN MONITORING AND EVALUATION

FORMAT - ANNUAL WATER MANAGEMENT PLAN

The following format shall be followed when completing the annual water management plan. For an example of this format, see 1984 Water Management Plan (refuge file 1360.00).

Purpose - state purpose and give general introduction to plan

Objectives - Primary objectives as stated in Refuge Management Plan

EACH DIVISION

General Information - area description, general management strategies

Previous Year's Water Use Data - Describe all water management activities, plans versus accomplishments, monitoring and evaluation of activities, results.

Annual Plan -

Primary Objectives for the Year - in regard to wildlife.

Water Manipulation - describe step by step procedures for each MSU, other water areas - what will it accomplish

Rehabilitation, Cyclical Maintenance, and Development - describe planned projects - desired results, manpower and equipment requirements

Appendices -

1. Monthly precipitation chart
2. MSU evaluation forms
3. Project descriptions, cost analysis and maps for new projects.

MSU # _____ YEAR 19 _____

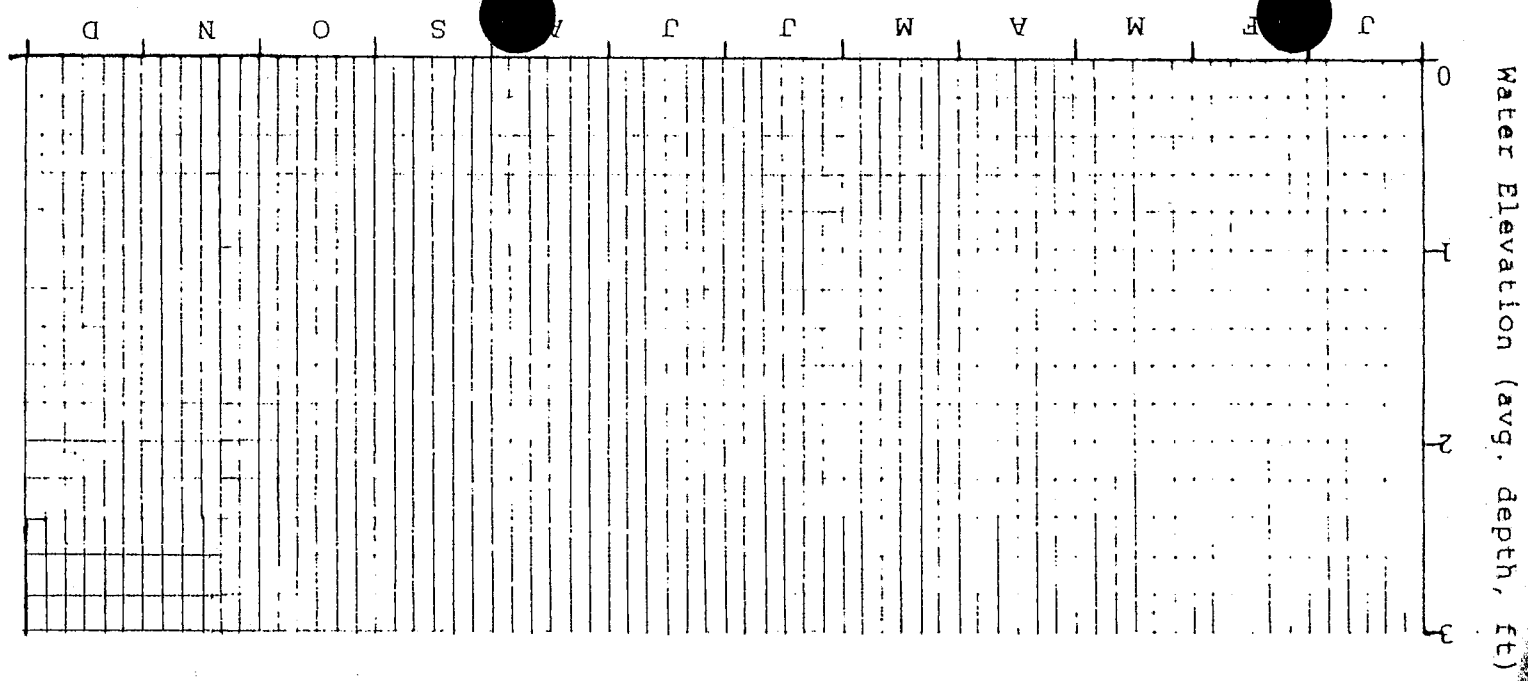
VEGETATIVE TRANSECT DATE _____
DOMINANT VEGETATION AND % _____

WILDLIFE USE

SKETCH

Use _____
Days _____
% Change from 19 _____

Ducks _____
Geese _____
Thr. spp. _____
Other migr. _____
WF Prod. _____



VEGETATIVE TRANSECT REPORT

DIVISION _____

DATE _____

AREA _____

OBSERVER _____

TRANSECT ROUTE _____

SAMPLE STATIONS_____

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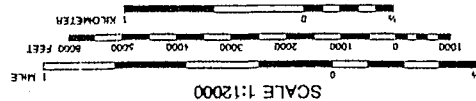
CLARENCE CANNON N.W.R.

MARK TWAIN NATIONAL WILDLIFE REFUGE

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR



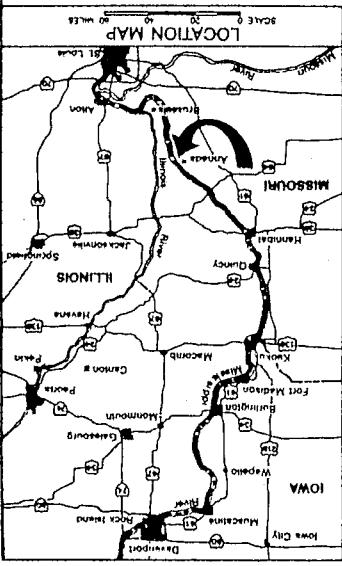
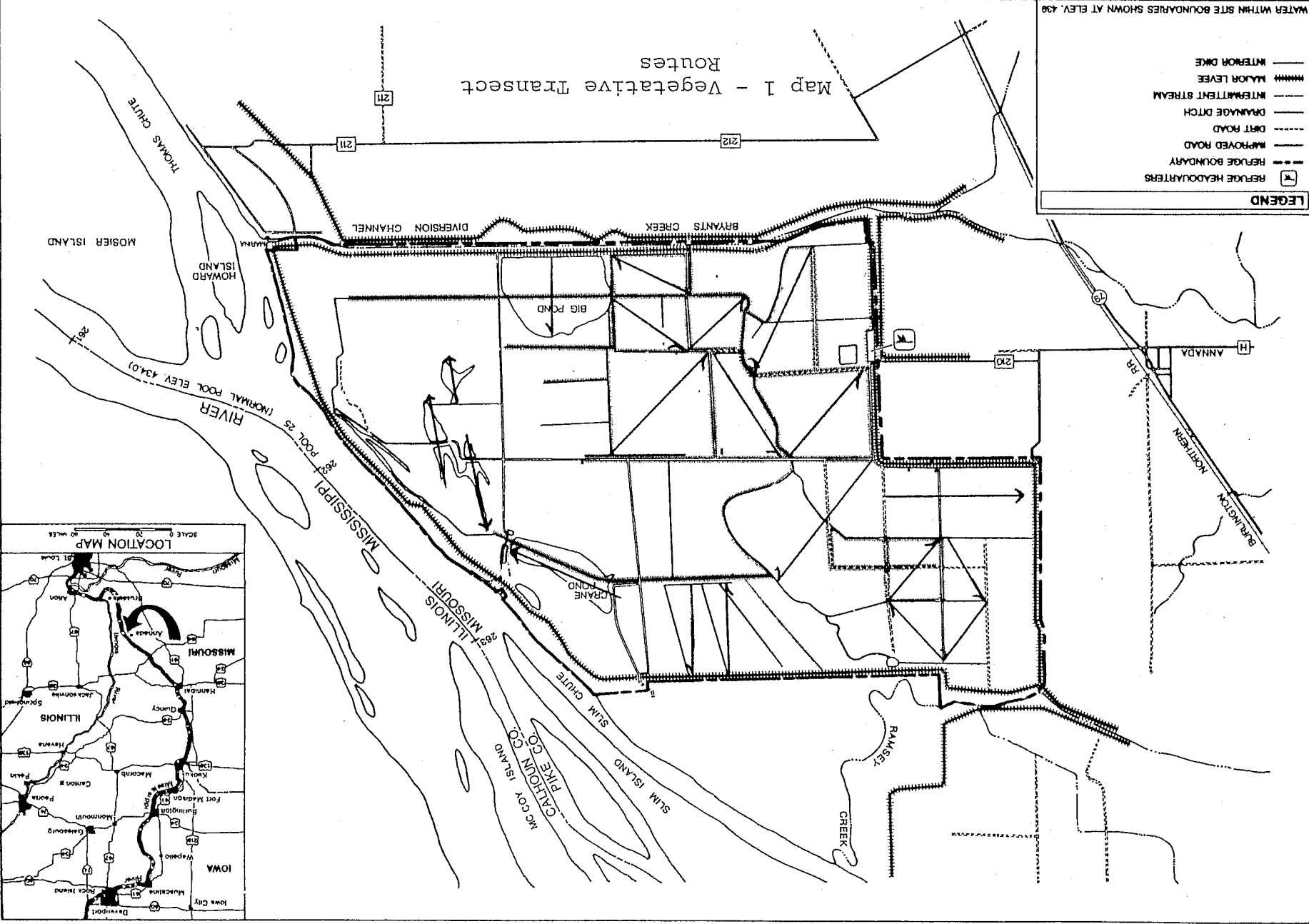
MAP LOCATIONS



- LEGEND**
- REFUGE HEADQUARTERS
 - REFUGE BOUNDARY
 - APPROVED ROAD
 - DIRT ROAD
 - DRAINAGE DITCH
 - INTERMITTENT STREAM
 - MAJOR LEVEE
 - INTERIOR DIKE

WATER WITHIN SITE BOUNDARIES SHOWN AT ELEV. 430

Map 1 - Vegetative Transect
Routes



VEGETATIVE TRANSECT FIELD FORM

DIVISION _____

DATE _____

AREA _____

OBSERVER _____

TRANSECT ROUTE _____

#	SAMPLE STATIONS	DISTANCE BETWEEN STATIONS
1	100	100
2	200	200
3	300	300
4	400	400
5	500	500
6	600	600
7	700	700
8	800	800
9	900	900
10	1000	1000
11	1100	1100
12	1200	1200
13	1300	1300
14	1400	1400
15	1500	1500
16	1600	1600
17	1700	1700
18	1800	1800
19	1900	1900
20	2000	2000
21	2100	2100
22	2200	2200
23	2300	2300
24	2400	2400
25	2500	2500
26	2600	2600
27	2700	2700
28	2800	2800
29	2900	2900
30	3000	3000
31	3100	3100
32	3200	3200
33	3300	3300
34	3400	3400
35	3500	3500
36	3600	3600
37	3700	3700
38	3800	3800
39	3900	3900
40	4000	4000
41	4100	4100
42	4200	4200
43	4300	4300
44	4400	4400
45	4500	4500
46	4600	4600
47	4700	4700
48	4800	4800
49	4900	4900
50	5000	5000
51	5100	5100
52	5200	5200
53	5300	5300
54	5400	5400
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61	6100	6100
62	6200	6200
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64	6400	6400
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66	6600	6600
67	6700	6700
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69	6900	6900
70	7000	7000
71	7100	7100
72	7200	7200
73	7300	7300
74	7400	7400
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79	7900	7900
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82	8200	8200
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85	8500	8500
86	8600	8600
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88	8800	8800
89	8900	8900
90	9000	9000
91	9100	9100
92	9200	9200
93	9300	9300
94	9400	9400
95	9500	9500
96	9600	9600
97	9700	9700
98	9800	9800
99	9900	9900
100	10000	10000

STOP #	SPECIES	STEM/M ²	AVG HEIGHT (INCHES)	SEEDS PRESENT

CLARENCE CANNON N.W.R.

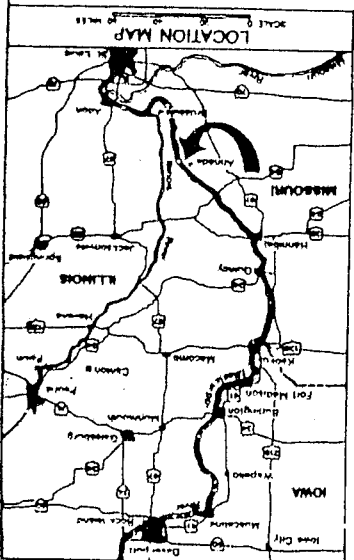
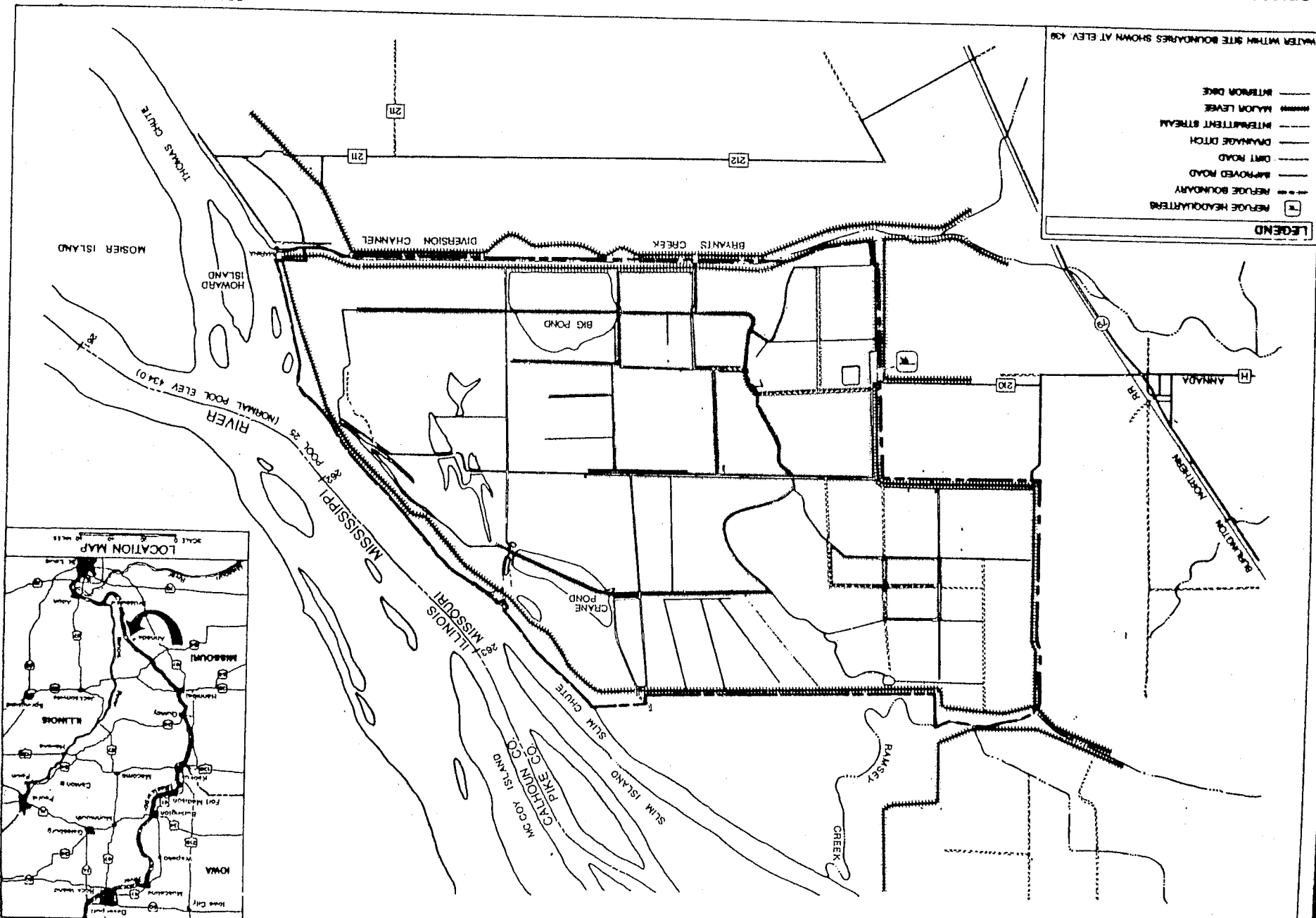
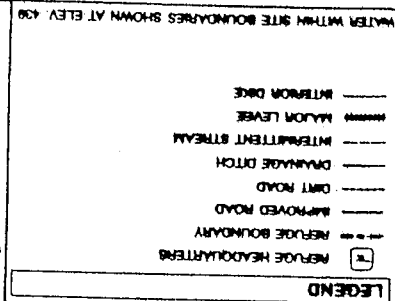
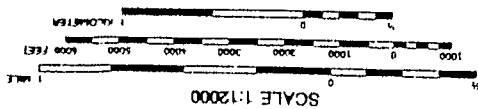
CENSUS ROUTE AND SPECIAL OBSERVATIONS

MARK TWIN NATIONAL WILDLIFE REFUGE

U.S. FISH AND WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR



27



TOTAL SPECIES

DIVISION

OTHER MIGRATORY SPECIES CENSUS FORM

DATE

Pied-Billed Grebe

American Bittern

Great Blue Heron

Common Egret

Cattle Egret

Sora

Herring Gull

Ring-Billed Gull

Common Snipe

Pectoral Sandpiper

Least Sandpiper

Semipalmated Sandpiper

Greater Yellowlegs

Lesser Yellowlegs

Solitary Sandpiper

Spotted Sandpiper

Black-Bellied Plover

Golden Plover

Killdeer

Mourning Dove

Turkey Vulture

Marsh Hawk

Red-Tailed Hawk

Golden Eagle

Bald Eagle

American Osprey

Osprey